Space Weather Technical Forecast

Issued on Thursday, 24 February 2022 at 01:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Very slight chance of moderate solar activity. Electron fluence increasing through the period.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been very low over the last 24 hours, with no significant flare activity. There are three sunspot regions on the visible disc. AR2953 (Bxo/Beta) is fading, with AR2954 (Hsx/Alpha) stable and unchanging. AR2955 (Cho/Beta) is the most significant region, but has not evolved much during the last 24 hours. No Earth-directed CMEs were observed in the available imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, has been variable through the last 24 hours, reaching peaks of around 550km/s but occasionally falling to around 450km/s. This is mainly due to the fitful decline in speeds from the high speed stream connected to coronal hole 56. Density has been around or above average. Total magnetic field strength (IMF), Bt has been weak, with the north-south component, Bz, varying weakly. The phi angle has been mainly positive, with brief rotations into the negative orientation. Resultant geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV) has been at normal background to moderate levels. The corresponding 24-hour integrated electron fluence is well below the Active (1e8 integrated pfu) threshold, with a neutral profile, having increased at the start of the period. The 23/2100 UTC observation was 1.26e7 pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is forecast to be low or very low, with a very slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the forecast. Earth is forecast to connect with a further high speed stream on day 2 (25 February) and then again on day 4 (27 February). However, a CME glancing blow is possible early on 24 February, but is considered a very low risk. Geomagnetic activity is expected to be mainly Quiet but there's a very slight chance of Active or G1/Minor Storms due to any CME effects on day 1. Active intervals are possible due to the forecast high speed stream connections on day 2 and day 4.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2MeV) is expected to increasingly persist above the high threshold during the period. Electron fluence is expected to follow an upward trend, with a likelihood of exceeding the Active (1e8 integrated pfu) threshold by days 3 and 4.

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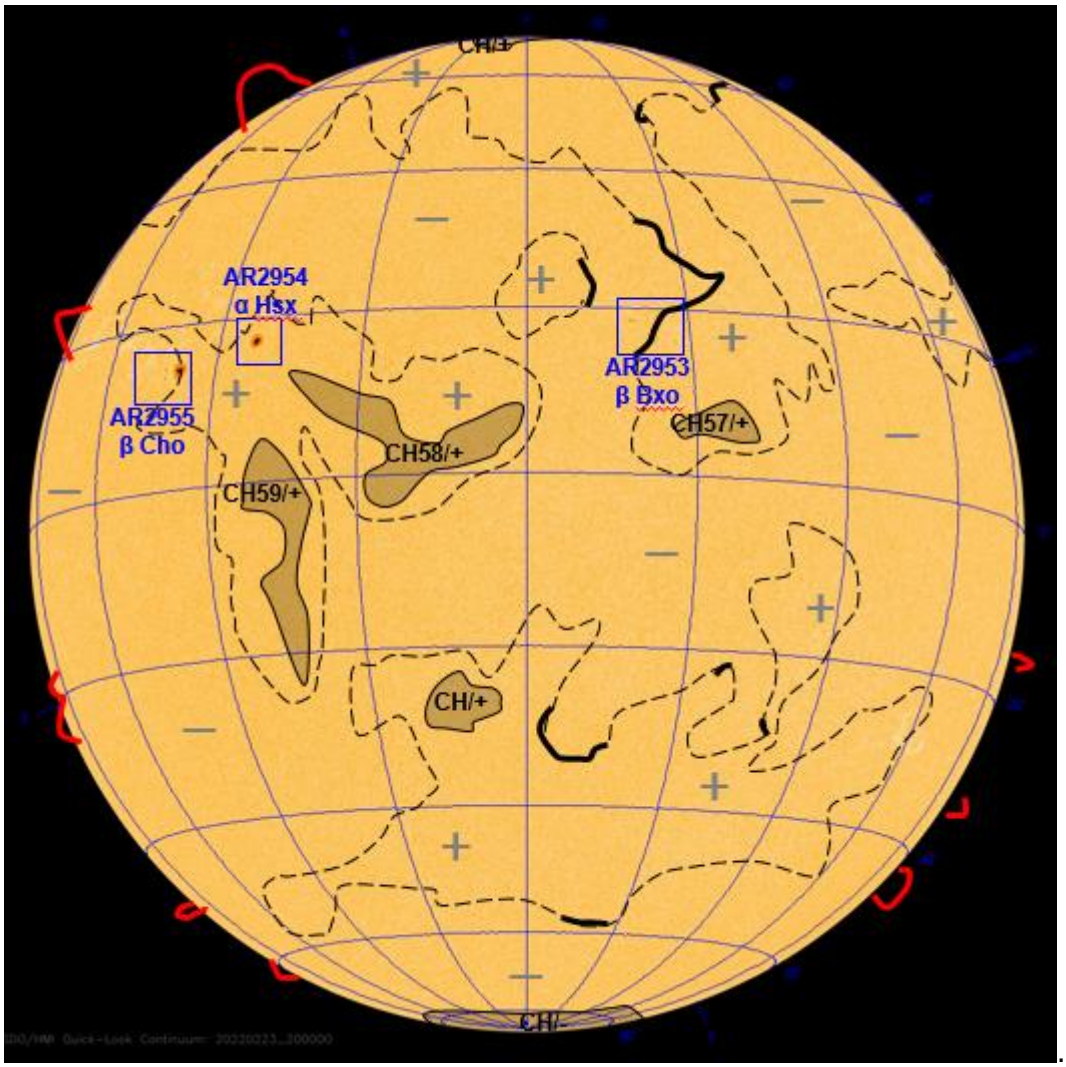
Figure 1. Solar Analysis Valid 23/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs forecast, although there is a slight chance of a weak CME glancing the Earth on day 1 (24 February) from a feature which left the Sun on 19 February. The high speed stream from coronal hole 56 will continue to fade during day 1. A further high speed stream from coronal hole 57 may then connect with Earth on day 2 (25 February) producing speeds in the range of 400-500km/s, based on STEREO A data. A further high speed stream from coronal hole 58 may then connect with the Earth late on day 4 (27 February) with speeds of 500km/s possible.

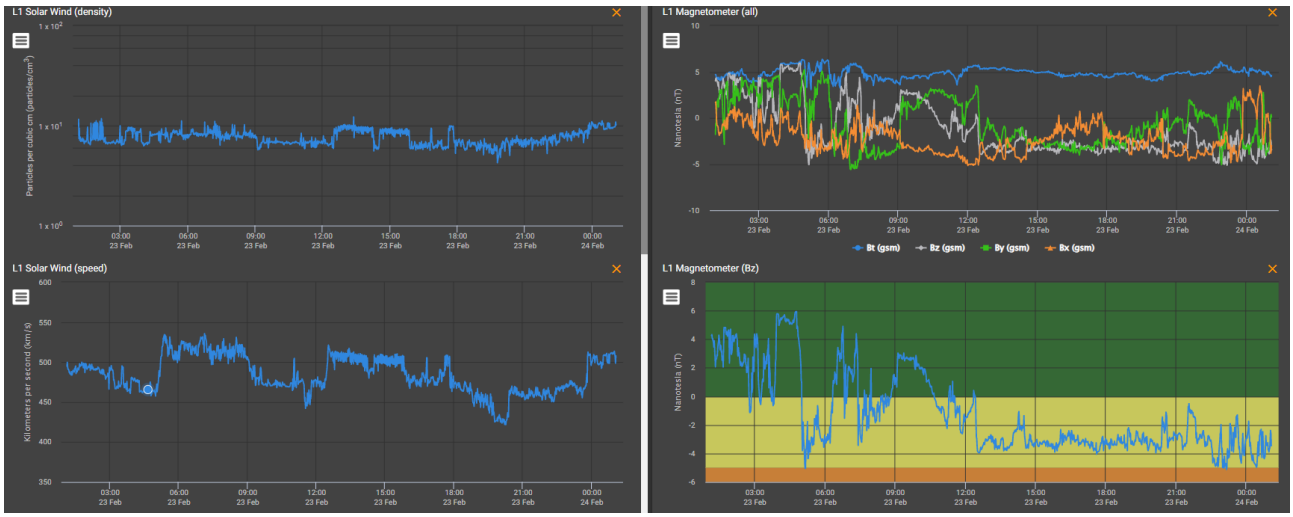
Geomagnetic activity is forecast to be mainly Quiet, but with a very slight chance of Active or G1/Minor Storm intervals on day 1 from the possible CME. Further Active intervals are possible on day 2 and 4 due to anticipated coronal hole high speed stream connections.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected

Figure 2: Recent solar wind observations from DSCOVR.



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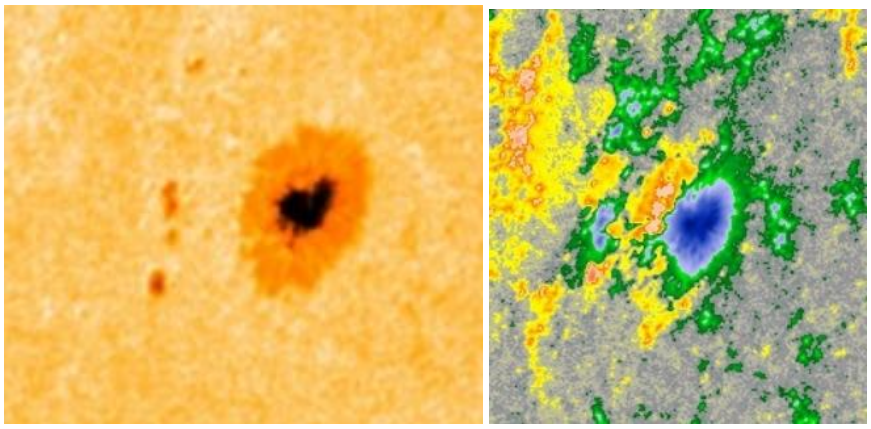
Radio Blackouts - X-Ray Flares:
There are three sunspot regions on the visible disc. 2953 (Bxo/Beta) appears to be fading, with 2954 (Hsx/Alpha) appearing to be stable. 2955, is the largest and most complex of the regions, but is only evolving slowly.

Low or very low solar activity is forecast, with a very slight chance of moderate activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: AR2955 (Cho/Beta). The region has not changed much in the last 24 hours, but constitutes the largest risk of flares on the visible disc.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES 16 is at background levels. Unless we see further significant flares it is likely to remain unchanged.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

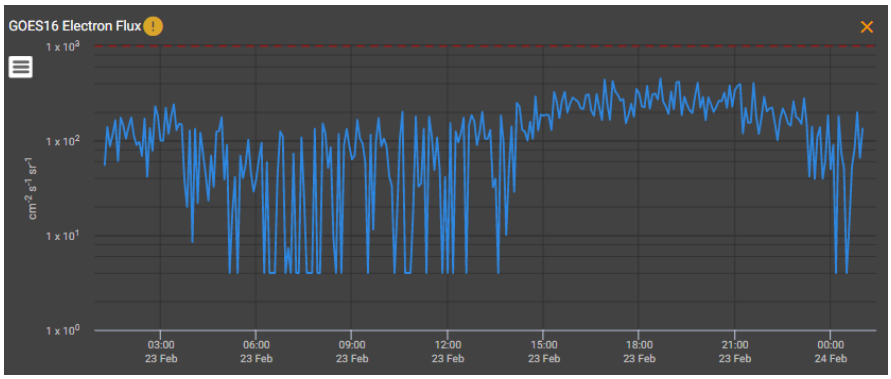
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) has been varying between background and moderate levels, becoming increasingly higher on diurnal peaks due to the elevated high speed stream. Further high speed streams are likely to lead to further increases on days 2 and 4, with high levels expected to become more persistent by day 4.

Electron fluence is expected to follow a rising trend, with a likelihood of exceeding the Active (1e8 integrated pfu) threshold by days 3 and 4.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	40	50	60	60
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	5

Figure 4: GOES-16 electron flux for the last 24 hours.



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